

A Tale of Two Chambers: Iterative Approaches and Lessons Learned from Life Support Systems Testing in Altitude Chambers.

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The drive for the journey to Mars is in a higher gear than ever before. We are developing new spacecraft and life support systems to take humans to the Red Planet.

The journey that development hardware takes before its final incarnation in a fully integrated spacecraft can take years, as is the case for the Orion environmental control and life support system (ECLSS).

Through the Pressure Integrated Suit Test (PIST) series, NASA personnel at Johnson Space Center have been characterizing the behavior of a closed loop ECLSS in the event of cabin depressurization. This kind of testing – one of the most hazardous activities performed at JSC – requires an iterative approach, increasing in complexity and hazards). The PIST series, conducted in the Crew and Thermal Systems Division (CTSD) 11-ft Chamber, started with unmanned test precursors before moving to a human-in-the-loop phase, and continues to evolve with the eventual goal of a qualification test for the final system that will be installed on Orion.

Meanwhile, the Human Exploration Spacecraft Testbed for Integration and Advancement (HESTIA) program is an effort to research and develop technologies that will work in concert to support habitation on Mars. September 2015 marked the first unmanned HESTIA test, with the goal of characterizing how ECLSS technologies work together in a closed environment. HESTIA will culminate in crewed testing, but it can benefit from the lessons learned from another test that is farther ahead in its development and life cycle.

Discussing PIST and HESTIA, this paper illustrates how we approach testing, the kind of information that facility teams need to ensure efficient collaborations and successful testing, and how we can apply what we learn to execute future tests.